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(54) Differential capacitance pressure transducer

(57) A differential capacitance pressure transducer comprises a resilient diaphragm (4) which is sealingly supported between a pair of body components (1) made of high alumina ceramic material which together define a pressure chamber divided by the diaphragm. The diaphragm (4) is made of high alumina ceramic material or glass and the opposite adjacent surfaces of the body components are apertured 2 to enable a differential fluid pressure to be applied to the pressure chamber on each side of the diaphragm; electrodes 3 extend into the body components to make contact with coatings of electrically conductive material on the body components. These electrodes and metal layer 4a on the diaphragm are intended to be connected to an alternating current measuring circuit to enable changes in transducer capacity and hence changes in differential fluid pressure to be indicated and/or recorded.

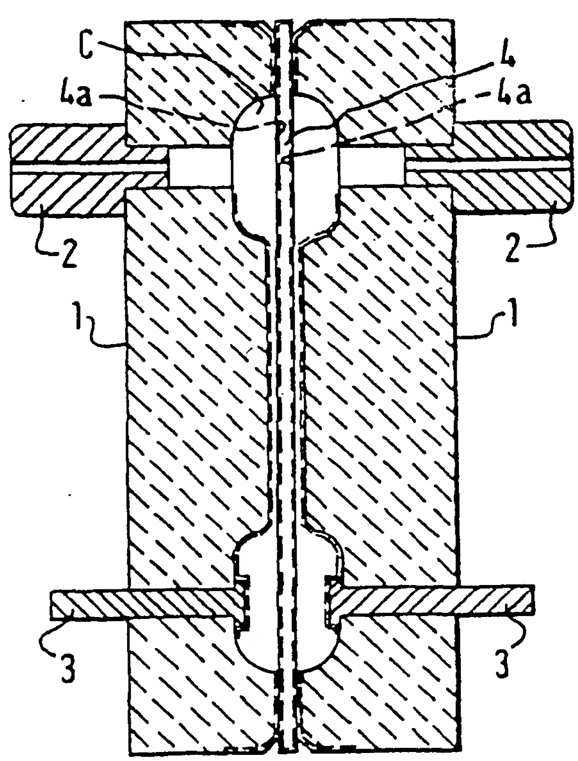

FIG.1.

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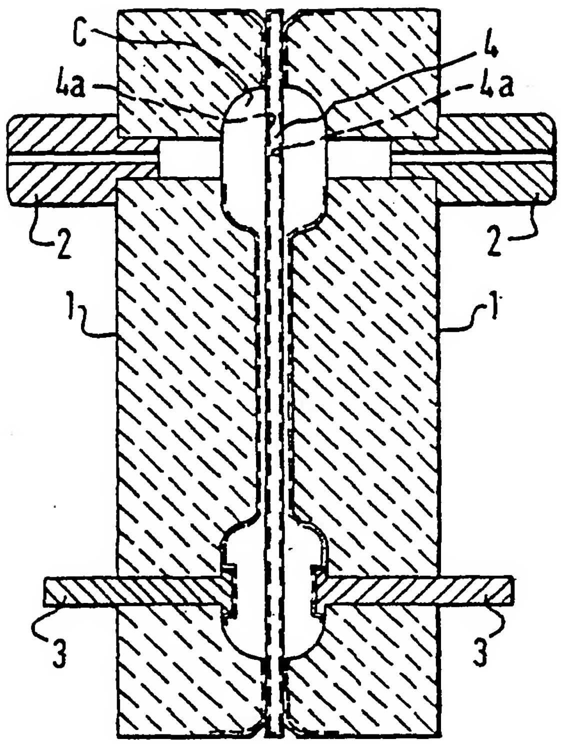

FIG.1.

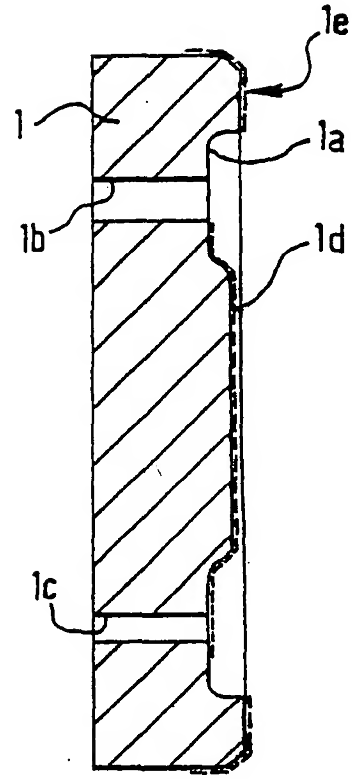

FIG.3.

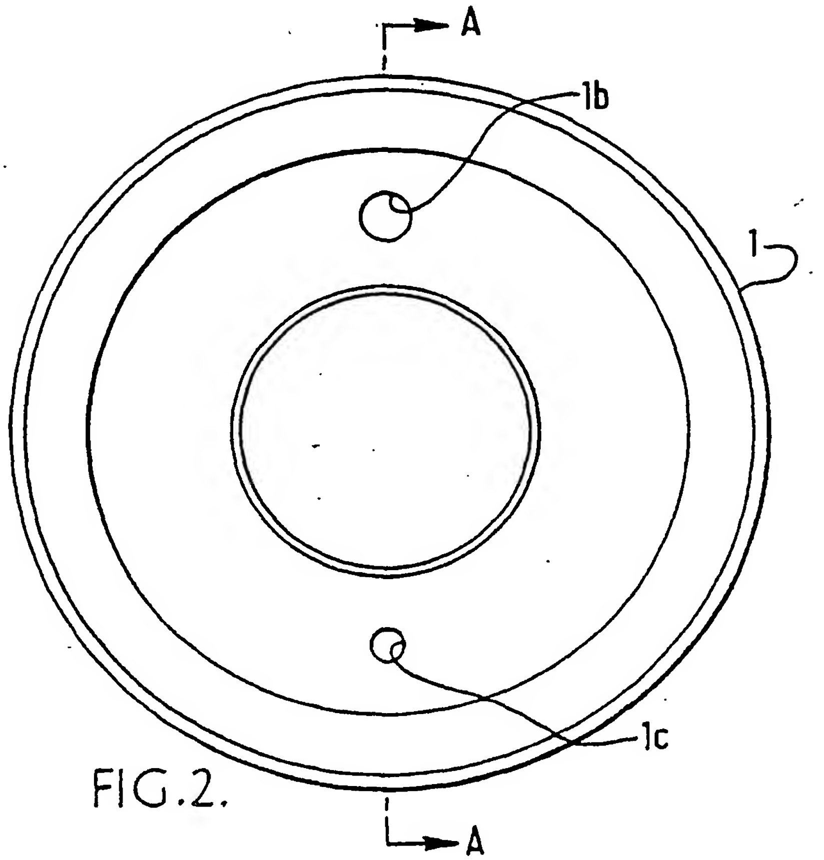

FIG.2.

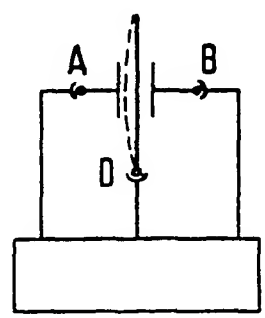

FIG.4.

SPECIFICATION

Differential capacitance pressure transducer

This Invention relates to a Transducer which is adapted to measure differential fluid pressures or variations therein through the medium of electrical capacitance or changes thereof.

In accordance with the invention a differential capacitance pressure transducer comprises a resilient diaphragm which is sealingly supported between a pair of body components made of high alumina ceramic material which together define a pressure chamber divided by the diaphragm, the diaphragm being made of high alumina ceramic material or glass, the opposite adjacent surface of the diaphragm and the body components being coated with an electrically conductive material, the body components being apertured to enable a differential fluid pressure to be applied to the pressure chamber on each side of the diaphragm, and electrodes extending into the body components to make contact with the metal coatings thereof.

The electrodes and the metal coated part of the diaphragm are intended to be connected into an alternating current measuring circuit by which changes in capacitance of the transducer caused by deflection of the diaphragm under differential pressure can be detected and measured as an indication of such pressure or changes thereof.

A preferred embodiment of the invention is illustrated in the accompanying drawings in which:-

Figure 1 is a cross-section in a plane containing the central axis of the transducer.

Figure 2 is an end view of a transducer body component;

Figure 3 is a cross-section on line A-A of Figure 2; whilst

Figure 4 shows the mode of connection of the transducer into an A.C. bridge network, this being one of many types of alternating current measuring circuit.

Referring now to the drawings the differential capacitance pressure transducer essentially comprises a pair of body components 1 each in the form of a circular disc made of high alumina (90% and above) ceramic material. One example which proved to be satisfactory utilized 97.5% Alumina. The discs 1 are identical and have an annular recess 1*a* in one face, a bore 1*b* for accommodating a metal pressure port connector 2, and a somewhat smaller diameter bore 1*c* for accommodating an electrode pin 3. The central part of the recessed side of each disc 1 has a coating 1*d* of electrically conductive material indicated by a chain line in Figure 1 and with which an electrode pin 3 is intended to be connected.

The outer peripheral part of the recessed side of each disc 1 has a similar coating 1*e* of electrically conductive material indicated by a chain line in Figure 1. The coating 1*e* is used to provide electrical contact with the diaphragm coating 4*a* to enable a ground connection to be made (letter D Figure 4) when the two discs 1 and diaphragm 4 are assem- form of a simple circular disc 4 which is sandwiched between the body component discs 1 and adhesively secured thereto in a fluid-tight manner. This diaphragm 4 is also made of a high alumina ceramic material or glass and has on each side an electrically conductive coating 4*a*. As can be seen from Figure 1, the diaphragm 4 extends centrally across a chamber C formed between the annular recesses 1*a* of the body components and their spaced parallel central parts. Both faces of the diaphragm are coated with an electrically conductive layer and these layers constitute a movable electrode the diaphragm being resiliently deformable as a consequence of different pressures prevailing in the parts of the chamber adjacent its respective sides so as to vary the capacitance of each side of the transducer.

Various adhesives may be used for securing the interfaces of the body components and the diaphragm. One such adhesive is a cyanoacrylate.

One method of assembly entails the clamping of the body components 1 and diaphragm 4 together in a manner which provides pressure contact between the electrically conductive coatings 1*e* and 4*a*, and whilst maintaining this clamping pressure an application of cyanoacrylate is provided around the circumferential joints. In some instances, the application of a sealant around the circumferential joints may be required in addition.

Figure 4 shows the mode of connecting (A,B) to the metallic coatings 1*d* of the respective body components and (D) the metallic coating 4*a* of the diaphragm into an A.C. Bridge Network. As will be appreciated when the diaphragm 4 moves into the position shown by the dashed lines as a consequence of a change in differential pressure acting thereon, there will be a measurable change in the capacitances of the transducer which can be indicated and/or recorded.

The sensitivity of transducers as above described can be determined by performance of a test in which a fluid pressure is applied to each side of the transducer in turn whilst the capacitance of both sides of the transducer is measured. The capacitance of each side for a given pressure - e.g. 10"W.G. or 2500 Pa - is then compared with the zero differential pressure capacitance. The difference between the zero differential pressure reading and the 10"W.G. pressure reading can then be expressed as a percentage of the zero differential pressure reading for each side in turn. This percentage change in capacitance represents the sensitivity of the transducer.

Sensitivity is mostly dependent upon:-

(a) the initial capacitance of the transducer at zero differential pressure, and (b) the tolerance on diaphragm thickness.

When the initial capacitances are high, the sensitivity (percentage chang in capacitance) is high.

When the diaphragm thickness is at its lower limit, the sensitivity is greatest.

CLAIMS

1. A differential capacitance pressure transducer

made of high alumina ceramic material which together define a pressure chamber divided by the diaphragm, the diaphragm being made of high alumina ceramic material or glass, the opposite adjacent surfaces of the diaphragm and the body components being coated with an electrically conductive material, the body components being apertured to enable a differential fluid pressure to be applied to the pressure chamber on each side of the diaphragm and electrodes extending into the body components to make contact with the electrically conductive coatings.

2. A differential capacitance pressure transducer in accordance with Claim 1 in combination with an Alternating Current measuring circuit into which the said electrodes and the electrically conductive coating on the diaphragm are connected.

3. A differential capacitance pressure transducer constructed substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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